Lone Star Healthy Streams

Livestock BMP Monitoring

Southeast and South Central Texas Regional
Watershed Coordination Steering Committee

June 7, 2012

Grazingland Research

- Problem:
  - Bacterial loading from cattle identified as contributing to impairment
  - Fencing of streams not accepted by many landowners
- Response:
  - 5 yr study on more acceptable practices
  - Study conducted by Texas AgriLife Extension Service, Texas AgriLife Research, Texas Water Resources Institute
  - Study funded by Texas State Soil and Water Conservation Board, USDA Natural Resources Conservation Service, US Environmental Protection Agency

Alternative water supply effectiveness

Reduction in Time Spent in Stream	Reference
43%	Wagner et al. 2011
85-94%	Miner et al. 1992 Clawson 1993 Sheffield et al. 1997

Alternative Water Source

Bacteria Reduction	Reference
85-95% (EC)	Byers et al. 2005
51% (FC)	Sheffield 1997
NSD (EC)	Wagner et al. 2011

- Sheffield (1997) also found reductions in:
  - Sedimentation (77%)
  - Suspended solids (90%)
  - Nitrogen (54%)
  - Phosphorus (81%)

Shade Structure GPS Collar Evaluation

- Shade, coupled with alternative water & salt/mineral locations, encourages cattle to spend less time in riparian areas.

Time Spent w/in 25′ of Stream	Testing Date
31% Reduction	October 2010
11% Reduction	June 2011

Rip-Rap of Critical Areas

- Option to fencing
- Provide permanent barrier
- Applicable primarily to critical areas only

Rip-Rap Size	Observed Effects
4-8″ diameter	• No Effect
12″ diameter	• Young heifers & calves – little effect • Heavier cows – impeded crossing

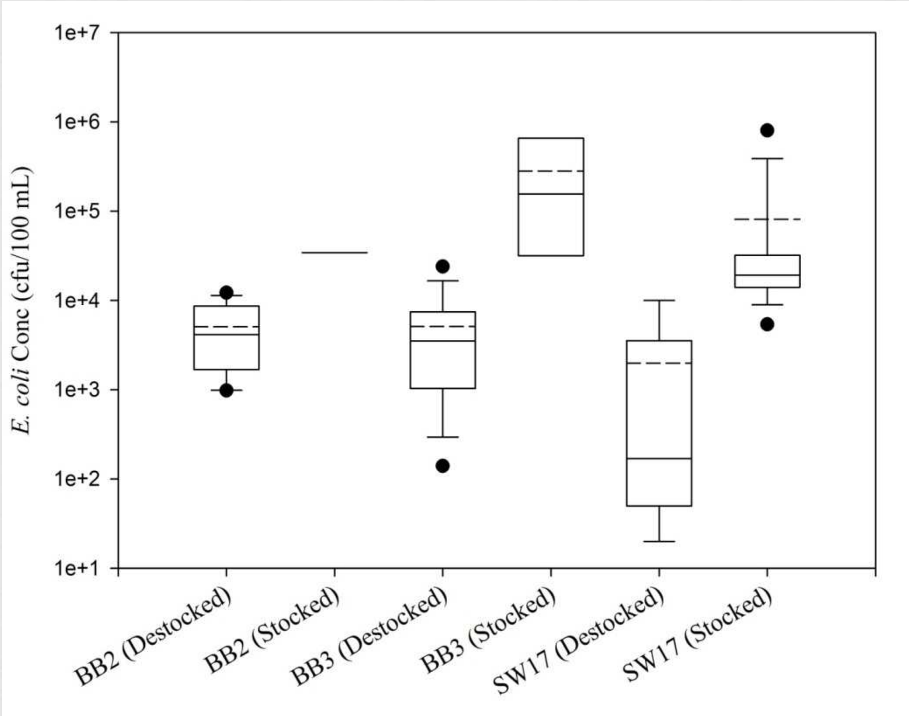
Exclusionary Fencing

- Eliminates cattle access to streams
- Expensive to construct & maintain
- Not feasible to fence-off entire stream in many cases
- Electric fencing may provide a lower-cost alternative

Fecal Coliform Reduction	**Reference**
30%	Brenner et al. 1994
41%	Brenner 1996
66%	Line 2003

Grazing Management

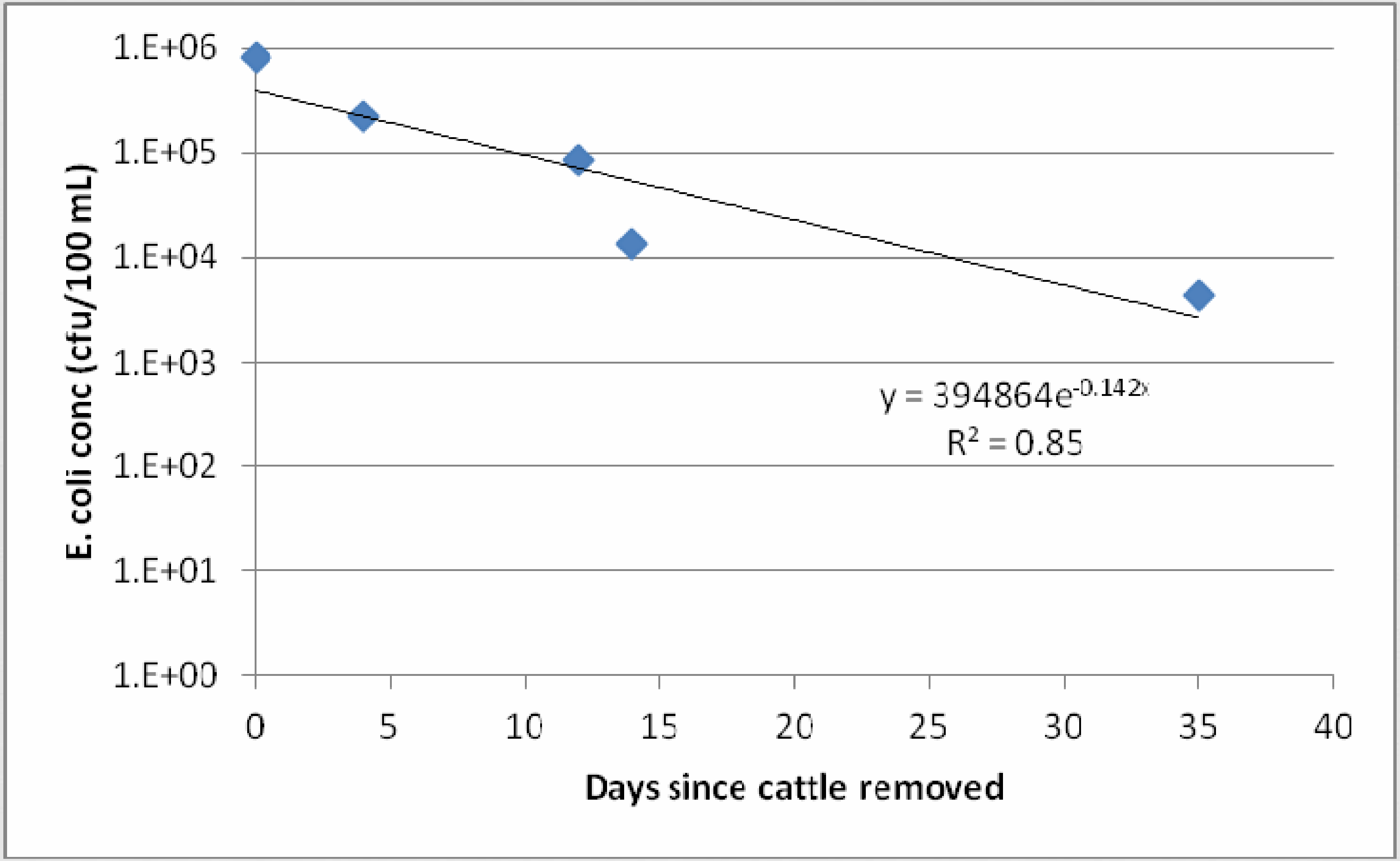
- Study showed:
  - **Rotational grazing of creek pastures during periods when runoff less likely may be an effective practice**
  - Timing of grazing (in relation to rainfall runoff events) was more important than proper grazing mgt or stocking rate
  - **88-99% reductions in bacteria runoff potentially achievable**



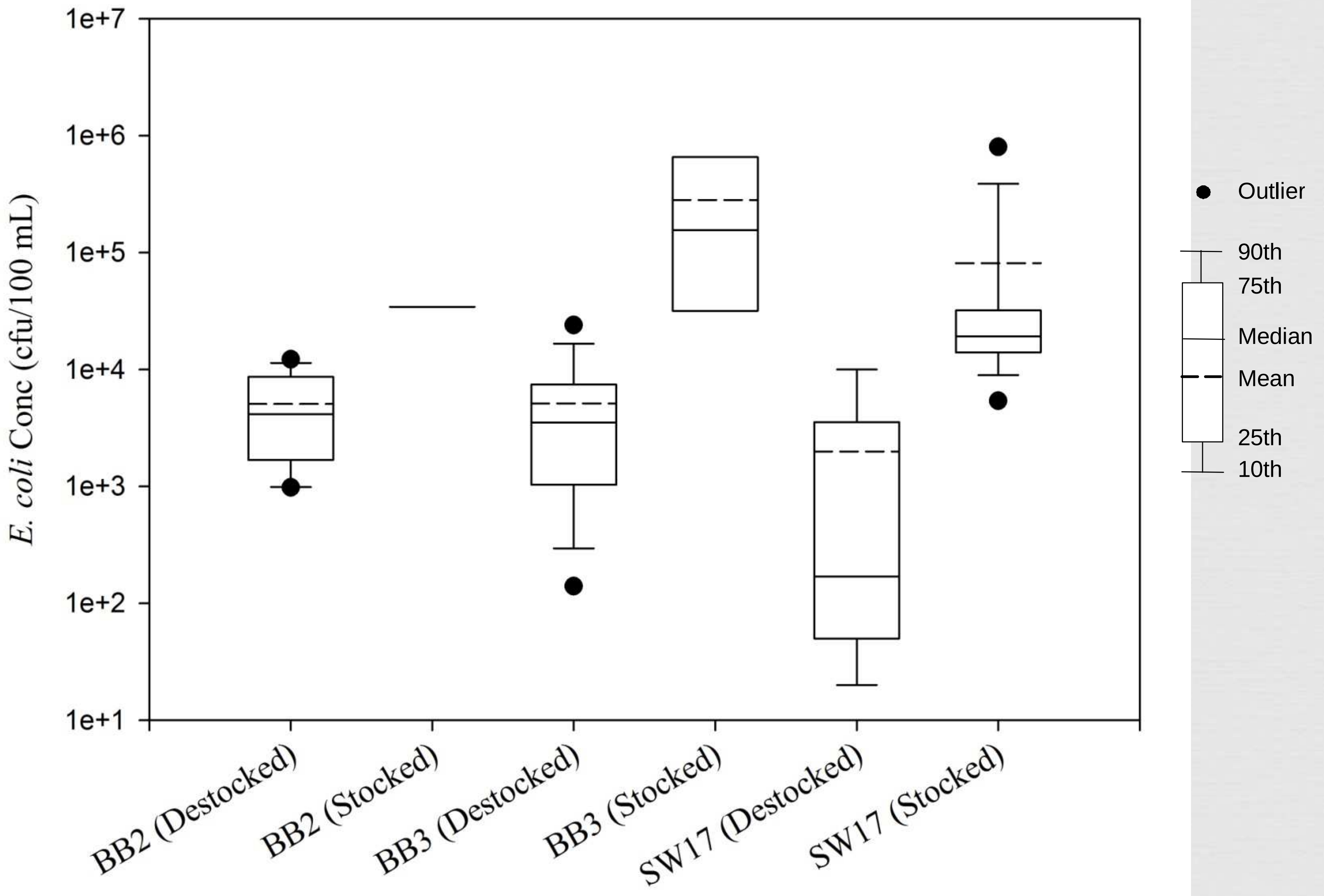
Other findings from grazing management evaluation

- E. coli levels in runoff decline rapidly following rotation
  - *Levels reach background levels within 1 month (typically 2 wks)*
- Background *E. coli* concentrations are **SIGNIFICANT**
  - *Median levels at ungrazed & destocked sites ranged from 3,500 to 5,500 cfu/100 ml (30-40 times allowable concentrations)*
  - *Current standards would require 98% reduction from ungrazed native prairie site at Riesel – has not been grazed since before 1937*
  - *Sources other than grazing cattle can significantly impact E. coli runoff from grazing lands*
    - *80-99% of loading from 3 sites in 2009 was from non-domesticated animals*
  - *Water quality models & water quality standards need to incorporate this*

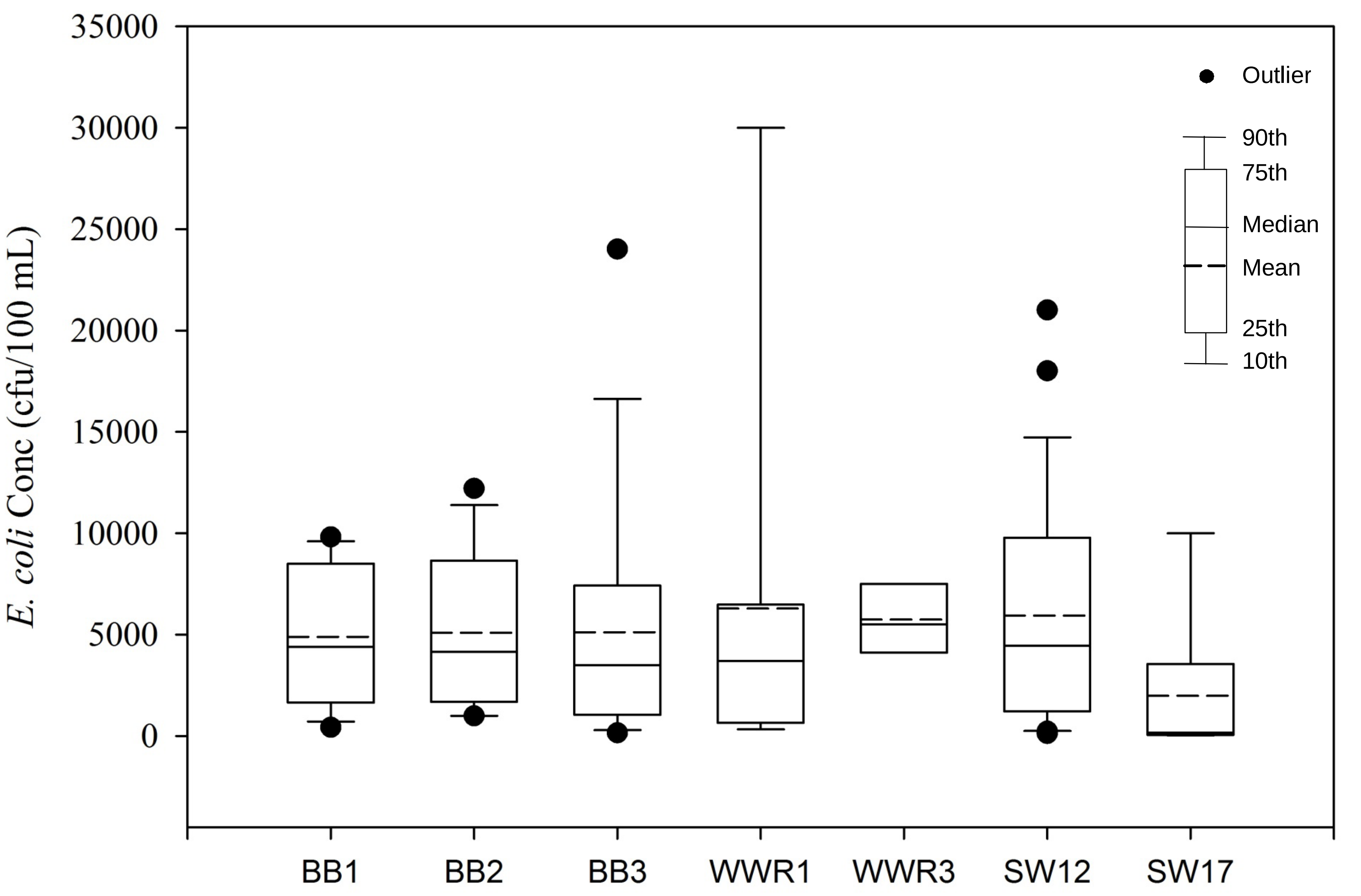
Decline in *E. coli* Levels in Runoff at BB3 Following De-Stocking



Comparison of *E. coli* Levels While Sites Stocked & Destocked



Background *E. coli* Concentrations



Mean Background Levels in Runoff

Site	Fecal Coliform (#/100 mL)	*E. coli* (cfu/100 mL)	Reference
Ungrazed pasture	10,000		Robbins et al. 1972
Ungrazed pasture	6,600		Doran et al. 1981
Control plots		6,800	Guzman et al. 2010
Pasture destocked >2 mos.		1,000-10,000	Collins et al. 2005
Ungrazed pasture		6,200-11,000	Wagner et al. 2012
Pasture destocked >2 wks.		2,200-6,000	Wagner et al. 2012

Impact of wildlife

Date	BB1	BB2	BB3
3/13/09			140
3/25/09	1,200		
3/26/09		1,000	7,200
3/27/09			2,000
4/17/09	1,155	980	450
4/18/09	4,400	2,225	2,100
4/28/09	7,600	12,200	24,000
10/4/09	57,000	5,114	3,065
10/9/09	36,000	24,043	15,000
10/13/09	42,851	23,826	5,591
10/22/09			172,500
10/26/09	261,000	181,000	45,000

Site	Stat	October 2009	Excluding Oct 2009 & grazed periods
BB1	Median*	49,926a	4,400b
	Max	261,000	9800
BB2	Median*	23,935a	4,150b
	Max	181,000	12,200
BB3	Median*	15,000a	3,500b
	Max	172,500	24,000

Where is the background E. coli coming from?

- Big game animals (deer, elk, feral hogs)
- Meso-mammals (opossums, raccoons)
- Small mammals (rodents)
- Avian wildlife (many migratory species)
- Naturalized, soilborne *E. coli* populations

http://animal-wildlife.blogspot.com/

Naturalized Soilborne E. coli

- E. coli found in soils in a wide array of environments
  - Tropical to northern temperate

- Some strains part of indigenous soil bacterial community, i.e. naturalized E. coli (Ishii et al. 2006)

- Significant levels possible in soil
  - As high as 3000 cfu/g soil in Minnesota (Ishii et al. 2006)
  - As high as 106 cfu/g dry soil in England (Oliver et al. 2010)

  - Potentially a sizeable component of total E. coli in water
  - 25% of E. coli strains in South Nation River, Ontario potentially represented naturalized E. coli (Lyautey et al. 2010)

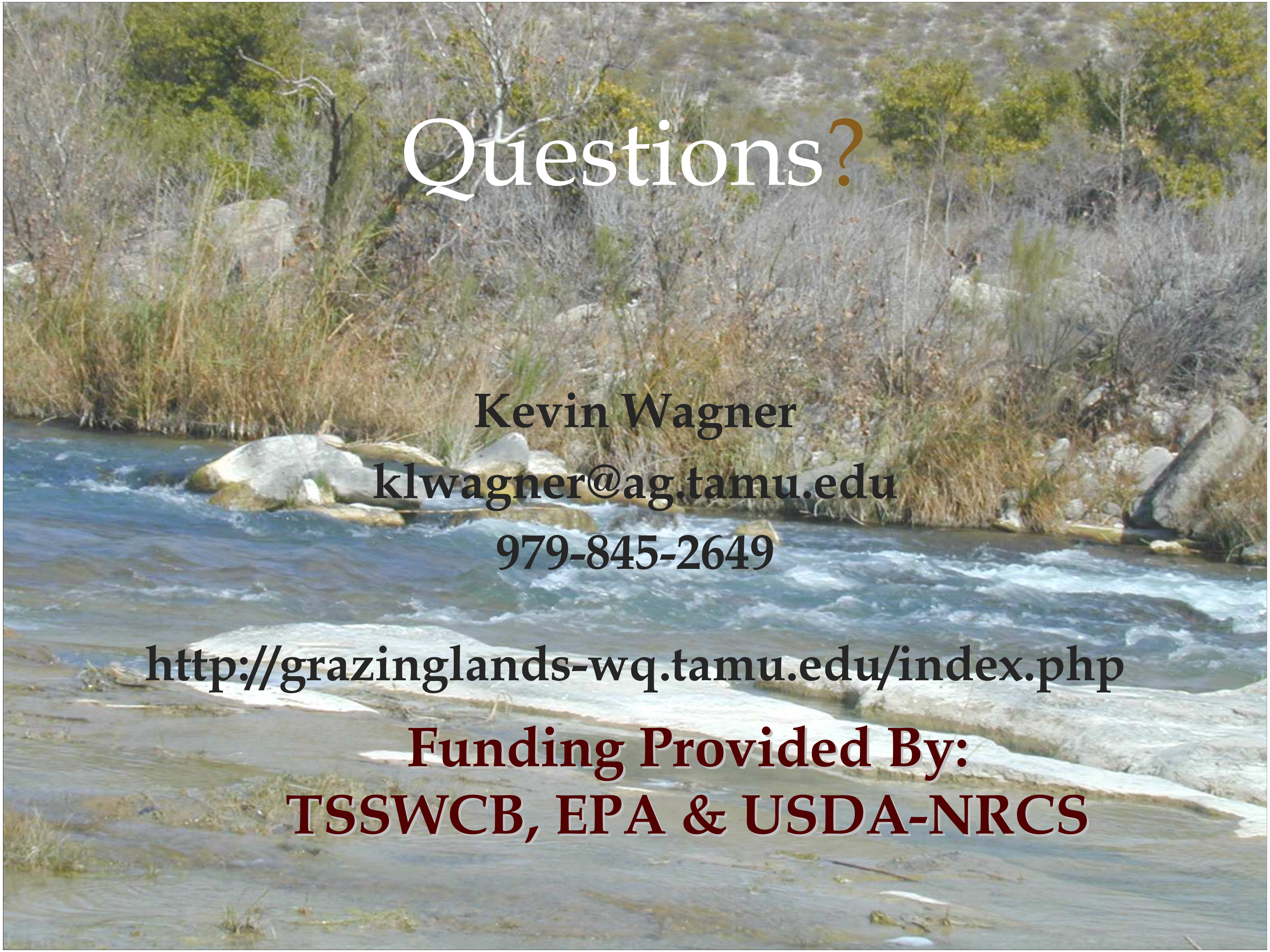
Why is background E. coli important?

- **Water quality standards**: Impacts application to samples collected during storm events (when edge-of-field runoff dominates flows.
  - Supports the case for stormwater exemptions

- **TMDLs & watershed based plans**: Ignoring background concentrations may lead to:
  - Inaccurate load allocations and reductions
  - Incongruence of modeling and BST results

Conclusions

- Background concentrations are significant component of total E. coli in runoff
- Need to be considered when allocating loads and assessing load reductions
- How do we integrate into water quality management?



Questions?

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